## Remarks

Claims 4-5, 14-26, 28-29 and 43 were previously cancelled. Claims 30-39 were previously withdrawn in response to a restriction requirement without prejudice to file these claims in a divisional application, and applicant has cancelled these claims in this paper without prejudice. Accordingly, claims 1-3, 6-13, 27, 40-42 and 44-50 are currently pending.

In the Office Action mailed on July 10, 2007, the examiner rejected claims 1-3, 6-12, 27, 40-42 and 44-50. The examiner indicated that claim 13 is allowable.

Claims 1 and 27 have been amended to recite the same proportions of ethylene glycol and propylene glycol as recited in allowed claim 13. Claims 3, 6-12, 40-42 and 44-50 depend from claims 1 or 27. Accordingly, claims 1-3, 6-13, 27, 40-42 and 44-50 are now in condition for allowance.

Applicant makes the forgoing amendments without prejudice to pursue additional claims supported by the specification in a continuation application.

Attached to response is a copy of the Declaration of John Evans dated April 9, 2007. This declaration had previously been submitted on April 12, 2007 with the spreadsheet referred to in Paragraph 6 of the declaration inadvertently omitted. The spreadsheet is attached to the copy of the Evans Declaration filed herewith. Applicant respectfully requests that the corrected copy of the Evans Declaration be entered in this case.

In view of the foregoing amendments and remarks, this application should now be in condition for allowance. A notice to this effect is respectfully requested. If the Examiner believes after considering these remarks, that the application is not in condition for allowance,

and in particular if a terminal disclaimer is required for allowance, the Examiner is requested to call the Applicant's attorney at the telephone number listed below.

Because the reasons above are sufficient to traverse the rejection, Applicants have not explored, nor do they now present, other possible reasons for traversing such rejections. Nonetheless, Applicants expressly reserve the right to do so, if appropriate, in response to any future Office Action.

No fee is believed to be required. However, if a fee is required or otherwise necessary to cover any deficiency in fees previously paid, authorization is hereby given to charge our Deposit Account No. 50-3569.

Respectfully submitted,

Date: September 6, 2007

By: E. E. Grondahl
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CERTIFICATE OF MAILING

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as First Class Mail in an envelope addressed to: Mail Stop: Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

| Date: April 12, 2007 | Name: Sherry B. Visintainer | Signature: Sherry B. Visintainer |
|---|---|---|

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | | |
|---|---|---|---|
| In re Application of John W. Evans et al. | ) | Examiner: | A. Khan |
| Serial No.: 09/910,947 | ) | Confirmation No.: | 9692 |
| Filing Date: July 19, 2001 | ) | Group Art Unit: | 1751 |
| For: Non-Aqueous Heat Transfer Fluid and Use Thereof | ) | Docket No.: | 97541.00007 |

Dated this 12th day of April, 2007

Mail Stop: Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

**DECLARATION OF JOHN EVANS**

I, John Evans, do hereby declare and say as follows:

1. I am an inventor of the above-referenced patent application regarding non-aqueous heat transfer fluids comprising ethylene glycol (EG) and propylene glycol (PG). I am also the Chairman of the assignee of the patent application, Evans Cooling Systems, Inc.

2. I am also the inventor on the reference cited by the examiner in the Office Action mailed on January 26, 2007, Evans WO96/37570.

3. At the time that Evans WO96/37570 was filed and at the time it was published, it was understood by those skilled in the art that when EG was added to either water or PG, the resulting mixtures had higher toxicity than either water or PG by itself. It was also commonly understood at these times that the acute oral rat $LD_{50}$ toxicity of a mixture could be estimated by taking the reciprocal of the sum of the decimal concentrations for each component divided by

their corresponding acute oral rat $LD_{50}$ toxicity values. This was my understanding at these times as well.

4. At the time of the filing and publication of Evans WO96/37570, it was my understanding was that EG was toxic, while PG was "Generally Regarded as Safe" by the US Food and Drug Administration. I understood that a combination of EG and PG would be less toxic than EG itself due to the dilution of the EG with PG, but I understood that the mixture would be acutely toxic at EG levels greater than 60% by weight.

5. Figure 1 of the instant application encompasses the prior art understanding (including my own as of the priority date of WO 96/37570) of the predicted acute oral rat $LD_{50}$ toxicity for mixtures of EG and PG. The estimated $LD_{50}$ for 60% EG and 40% PG is about 6,300 mg/kg.

6. The attached spreadsheet shows estimates for:

a. The acute oral rat $LD_{50}$ of GM-6038 concentrate, a typical antifreeze concentrate as of the priority date for WO 96/37570. The estimated $LD_{50}$ for the concentrate is shown to be 4,651 mg/kg.

b. The acute oral rat $LD_{50}$ of 50% GM-6038 concentrate and 50% water. The estimated $LD_{50}$ is 9,302 mg/kg.

c. The acute oral rat $LD_{50}$ of 60% GM-6038 concentrate and 40% water. The estimated $LD_{50}$ is 7,752 mg/kg.

d. The acute oral rat $LD_{50}$ of 60% GM-6038 concentrate and 40% water. The estimated $LD_{50}$ is 6,644 mg/kg.

7. According to the prior art understanding, EG exceeding 60% in mixtures with PG ($LD_{50}$ less than 6,300) would be more toxic than conventional antifreeze concentrates mixed with

30% water ($LD_{50}$ = 6,644). A concentrate mixed with 30% water is just about the most concentrated practical water-based coolant mixture. I believed for reasons of toxicity that 60% EG was the greatest tolerable percentage in a mixture with PG.

8. After the publication of Evans 96/37570, we discovered through toxicity tests the surprising and unexpected result that PG acts as an inhibitor for EG poisoning when it is mixed with EG, including the unexpected result that mixtures containing as much as 70% EG and 30% PG was less toxic than PG itself.

9. The atmospheric boiling points of both PG and EG (187.2° C and 197.3° C, respectively), are very much hotter than the boiling point of water (100° C). In an engine cooling system, boiling of coolant occurs locally at locations where large amounts of heat are generated and the surface area in contact with liquid coolant is small. As long as the vapor from the boiling condenses immediately into surrounding coolant, metal temperatures at the boiling locations are controlled to temperatures that are close to the boiling point of the fluid.

10. In the case of water/glycol fluids, the vapor from localized boiling is almost entirely water vapor. The water vapor may not condense readily because the surrounding water/glycol fluid can easily be hotter than the saturation temperature of water. In that event, a blanket of water vapor forms that insulates the engine metal at that location from the liquid coolant, causing a loss of control of the metal temperature.

11. Vapor blanketing is easily avoided with a high boiling point non-aqueous coolant because it is easy to maintain the bulk coolant substantially cooler than the saturation temperature of the coolant. With both PG and EG, the metal temperatures at boiling locations are easily controlled as a function of their respective boiling points. In addition to avoiding

vapor blanketing, however, controlling metal temperatures to reasonable levels also requires that the boiling point of the coolant not be too high.

13. As of the filing and publication date of Evans WO96/37570, I believed that the boiling point of ethylene glycol, 387.1° F (197.3° C), was at the upper limit for acceptable boiling points for non-aqueous fluids. PG has a boiling point that is 10° C degrees colder than the boiling point of EG. An EG and PG mixture containing at least 40% PG avoided pressing my upper limit.

14. PG and EG freeze at -60° C and -13.5° C, respectively. It was obvious that the high freezing temperature of neat EG was unsuitable for a heat transfer fluid that could be used without modification in virtually any environment in the world, a desired feature. A mixture of EG and PG, containing at least 40% PG would have a maximum freezing point of about minus 42° C, just about the upper limit for such a heat transfer fluid.

I, the undersigned, declare further that all statements made herein are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: April 9th, 2007

John W. Evans
John Evans

**LD50 estimate for a typical conventional antifreeze concentrate and LD50 estimates for the concentrate diluted with 50%, 40%, and 30% water.**

Formula for Estimating the LD50 of a mixture based upon the LD50 values of the mixture's ingredients:

$$C_A/T_A + C_B/T_B + C_C/T_C + \ldots + C_Z/T_Z = 100/T_{Mixture}$$

Where:

C = the % concentration of constituents A, B..., Z in the mixture.
T = the acute oral (rat) LD50 values of the constituents A, B..., Z.
$T_{Mixture}$ = the estimated acute oral (rat) LD50 value of the mixture.

**GM-6038 coolant formulation concentrate (a typical commercial antifreeze)**

| Ingredient | C Percent Conc. | T LD50 mg/kg | C/T |
|---|---|---|---|
| EG | 95.6500 | 4,700 | 0.020351 |
| $N_aNO_3$ | 0.2000 | 3,750 | 0.000053 |
| $Na_2B_4O_7*5H_2O$ | 1.0000 | 2,660 | 0.000376 |
| $Na_2SIO_3*5H_2O$ | 0.1500 | 1,280 | 0.000117 |
| $Na_3PO_4*12H_2O$ | 0.4500 | 17,000 | 0.000026 |
| NaMBT (50% SOLN) | 0.5500 | 3,120 | 0.000176 |
| NaOH | 0.2000 | 500 | 0.000400 |
| Pluronic L-61 | 0.0500 | N/A | 0.000000 |
| Green Dye | 0.0005 | N/A | 0.000000 |
| Water | 1.7500 | N/A | 0.000000 |
| Sum | | | 0.021500 |
| 100/Sum = **Estimated LD50 of GM-6038 concentrate:** | | | 4,651 |

**50 percent GM-6038 coolant concentrate and 50% water**

| Ingredient | Beginning Percent Concentration | C Pct Conc after adding water | T LD50 mg/kg | C/T |
|---|---|---|---|---|
| EG | 95.6500 | 47.8250 | 4,700 | 0.010176 |
| $N_aNO_3$ | 0.2000 | 0.1000 | 3,750 | 0.000027 |
| $Na_2B_4O_7*5H_2O$ | 1.0000 | 0.5000 | 2,660 | 0.000188 |
| $Na_2SIO_3*5H_2O$ | 0.1500 | 0.0750 | 1,280 | 0.000059 |
| $Na_3PO_4*12H_2O$ | 0.4500 | 0.2250 | 17,000 | 0.000013 |
| NaMBT (50% SOLN) | 0.5500 | 0.2750 | 3,120 | 0.000088 |
| NaOH | 0.2000 | 0.1000 | 500 | 0.000200 |
| Pluronic L-61 | 0.0500 | 0.0250 | N/A | 0.000000 |
| Green Dye | 0.0005 | 0.0003 | N/A | 0.000000 |
| Water | 1.7500 | 50.8750 | N/A | 0.000000 |
| Sum | | | | 0.010750 |
| 100/Sum = **Estimated LD50 of 50% GM-6038 concentrate and 50% water:** | | | | 9,302 |

## 60 percent GM-6038 coolant concentrate and 40% water

| Ingredient | Beginning Percent Concentration | C Pct Conc after adding water | T LD50 mg/kg | C/T |
|---|---|---|---|---|
| EG | 95.6500 | 57.3900 | 4,700 | 0.012211 |
| $N_aNO_3$ | 0.2000 | 0.1200 | 3,750 | 0.000032 |
| $Na_2B_4O_7*5H_2O$ | 1.0000 | 0.6000 | 2,660 | 0.000226 |
| $Na_2SIO_3*5H_2O$ | 0.1500 | 0.0900 | 1,280 | 0.000070 |
| $Na_3PO_4*12H_2O$ | 0.4500 | 0.2700 | 17,000 | 0.000016 |
| NaMBT (50% SOLN) | 0.5500 | 0.3300 | 3,120 | 0.000106 |
| NaOH | 0.2000 | 0.1200 | 500 | 0.000240 |
| Pluronic L-61 | 0.0500 | 0.0300 | N/A | 0.000000 |
| Green Dye | 0.0005 | 0.0003 | N/A | 0.000000 |
| Water | 1.7500 | 41.0500 | N/A | 0.000000 |
| Sum | | | | 0.012900 |
| 100/Sum = Estimated LD50 of 60% GM-6038 concentrate and 40% water: | | | | 7,752 |

## 70 percent GM-6038 coolant concentrate and 30% water

| Ingredient | Beginning Percent Concentration | C Pct Conc after adding water | T LD50 mg/kg | C/T |
|---|---|---|---|---|
| EG | 95.6500 | 66.9550 | 4,700 | 0.014246 |
| $N_aNO_3$ | 0.2000 | 0.1400 | 3,750 | 0.000037 |
| $Na_2B_4O_7*5H_2O$ | 1.0000 | 0.7000 | 2,660 | 0.000263 |
| $Na_2SIO_3*5H_2O$ | 0.1500 | 0.1050 | 1,280 | 0.000082 |
| $Na_3PO_4*12H_2O$ | 0.4500 | 0.3150 | 17,000 | 0.000019 |
| NaMBT (50% SOLN) | 0.5500 | 0.3850 | 3,120 | 0.000123 |
| NaOH | 0.2000 | 0.1400 | 500 | 0.000280 |
| Pluronic L-61 | 0.0500 | 0.0350 | N/A | 0.000000 |
| Green Dye | 0.0005 | 0.0004 | N/A | 0.000000 |
| Water | 1.7500 | 31.2250 | N/A | 0.000000 |
| Sum | | | | 0.015050 |
| 100/Sum = Estimated LD50 of 70% GM-6038 concentrate and 30% water: | | | | 6,644 |